

# REPORT DOCUMENTATION PAGE

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4. TITLE AND SUBTITLE A Proposal for the Purchase of SOC-500 Laser Interferometric Monostatic Reflectometer	5. FUNDING NUMBERS DAAD19-99-1-0042
6. AUTHOR(S) Zu Han Gu & Alex Maradudin	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of California - Irvine	8. PERFORMING ORGANIZATION REPORT NUMBER
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13. ABSTRACT (Maximum 200 words)

Two Instruments: 1) Correlation Measurement Unit, 2) Photon Correlate Function Measurement Unit have been constructed under the grant and are now operational. These will be used to various modes of scattering of coherent and partially coherent light forms, including speckle fatterous produced therefore. Applications will include 'finger-printing' for pattern recognition and discrimination, future 'hit-to-kill' interceptors and real-time imaging of threat targets.

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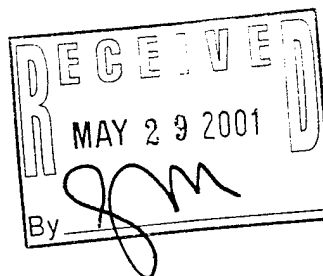


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May 25, 2001

Army Research Office  
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Research Triangle Park, NC 27709-2211

RE: Research Agreement No. DAAD19-99-1-0042 Final report

Gentlemen:

On the basis of my visit to the Surface Optics Corporation on Thursday morning, March 8, 2001, I attest that the construction of the two instruments:

Correlation Measurement (Memory Effect) Unit, Surface Optics Corp., Model SOC-500-0003  
Photon Correlate Function Measurement, Surface Optics Corp., Model XOC-500-0005

with support from Army Research Office grant # DAAD19-99-1-0042, has been completed, and the instruments are now operational. Data are already being taken by their use. The total cost of this equipment was \$100,000. (These instruments are an enhancement to the monostatic reflectometer acquired under DAAG55-98-1-0063.) A description of the instruments and their capabilities is attached.

Some of the research projects on which the equipment will be used are the following. The reflectometer will be used in measurements of the spectral shift of light scattered from a random surface (the Wolf shift). It will also be used in measurements of angular intensity correlation functions, including, but not limited to, the memory effect and the reciprocal memory effect. The reflectivity of, and the diffuse scattering of light from, a randomly rough surface that bounds an amplifying medium will also be investigated by means of this instrument. It can be used to measure the enhanced back-scattering peak within 3 degrees plus or minus of its maximum, and it will be used to simulate laser radar measurements.

The SOC-500 laser interferometric monostatic reflectometer has been used to support several research projects including enhanced backscattering, the memory effect, spectral change from rough surface scattering (Wolf effect), and grazing angle enhanced backscattering for two ongoing ARO contracts (DAAG55-98-C-0034, and DAAD19-99-1-0321). It can also be used for simulation and calibration of energy in the laser return for laser radar system design. Since SOC-500 provides, for the first time, the far-field speckle mapping of the target, the synthesized image of speckle can be widely used as 'finger printing' for pattern recognition and discrimination, the inverse problem, holographic speckle

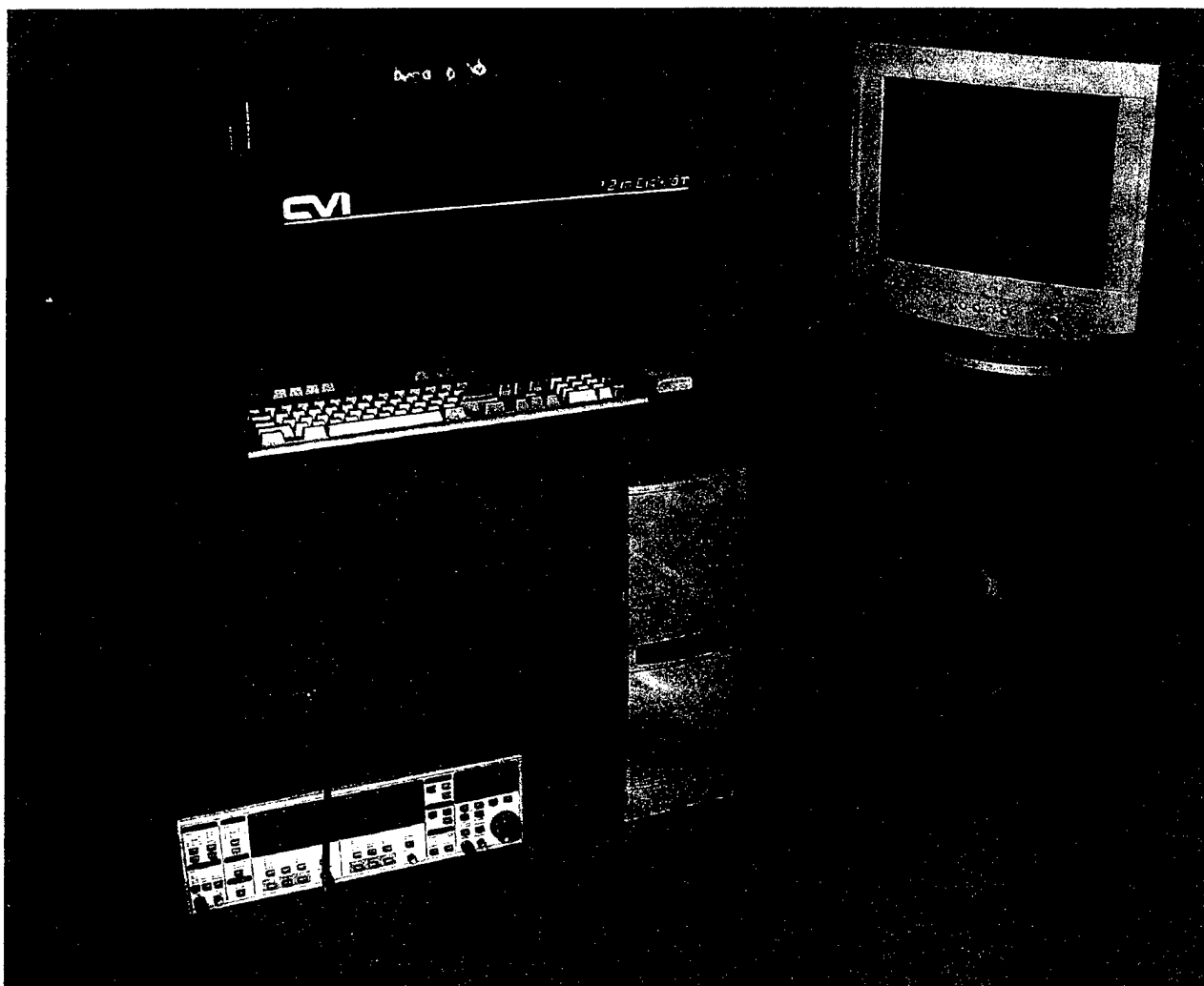
interferometry, and the determination of the high order correlations C2 and C3 for mesoscopic conductors. Future hit-to-kill interceptors and modern effective warheads require accurate real-time imaging of the vulnerable area of threat targets during the end game to achieve high kill capabilities. The holographic 3-D image provided by the SOC-500 will provide an accurate end game range, range rate, and time-to-go data in real time.

Sincerely,

A handwritten signature in black ink that reads "Alexei A. Maradudin". The script is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Alexei A. Maradudin  
Professor of Physics

AAM:ds  
attachment



## SOC-500-0005 Spectrometer

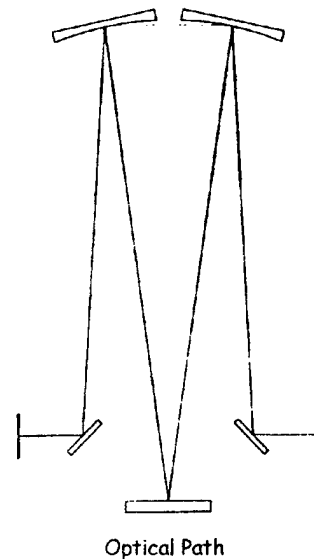
### Introduction

The SOC-500-0005 spectrometer is a supplementary option for the SOC-500 Broadband and Laser Interferometric Monostatic Reflectometer, which can be used for photon spectrum correlation measurement.

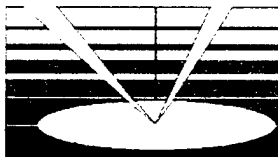
The photon spectrum correlation measurement is used for low light intensity in the experiment so that we have to count individual photons of light, which can be mounted at the detector plane of the SOC-500.

A correlator is basically a signal comparator. It is designed to measure the degree of similarity between two signals, or one signal with itself at varying time intervals.

Design:	Czerny-Turner Triple-grating turret standard
Focal Length:	480 mm
Spectral Range:	180-680 nm 400-1500 nm 1200-4000 nm
Wavelength precision and reproducibility:	0.007 nm standard (with 1200 g/mm grating)
Max Resolution:	0.03 nm (with 1200 g/mm grating) 0.015 nm (with 2400 g/mm grating)



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